Section of Tropical Diseases and Parasitology.

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Edible and Poisonous Fungi.

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THE edible or poisonous qualities of fungi are not the subject of the same interest in this country as they were to the ancients or to our more immediate ancestors, and probably most of us never partake of any fungus but the common mushroom except on the Continent, when a wild gastronomic adventure might include cèpes or escargots.

In classical times there was considerable interest taken in the edibility of fungi. Many instructions were given how to distinguish those which were safe from those which were not; and minute descriptions of the manner of preparing them for the table and for treating the guests in case of mishap. An often-quoted epigram of Martial that gold and silver and dresses might be trusted to a messenger but not boleti, indicates the esteem with which certain esculents were regarded.

The general public considers the common field mushroom and the coarse horse mushroom as the only species fit to eat. That other forms can also be eaten is generally known, though it is usually imagined that most toadstools are extremely poisonous. In any event the non-poisonous species are not thought worthy of any attention. It is remarkable that such beliefs should be prevalent when the facts are that few toadstools are poisonous and many of the edible ones are of much more delicate flavour than the common mushroom, either wild or cultivated. How are such edible species to be recognized? The several species are distinguished by their botanical characters: whether they are edible or poisonous is known only by experience. Fortunately the list of well-known esculents is sufficiently extended to warrant even the most confirmed mycophagist refusing to embark upon preliminary experiments.

All rule-of-thumb methods for distinguishing between edible and poisonous fungi are utterly useless. It is a matter of surprise that newspapers, which in these days publish many well-informed articles on various branches of natural history, should litter their pages every autumn with worthless notes on how poisonous and edible fungi may be distinguished. It is true that we are seldom, if ever, now told to avoid those species which grow near serpent's holes or near rusty nails but much of the remaining advice is the same as is to be found in Pliny. Although such "rules" are current in every nation they are worthless.

(1) It is often stated that poisonous fungi display one or other of certain characters. Nothing whatever can be told from their appearance though to "look poisonous" is often sufficient to repel the potential mycophagist. Viscidity and colour of exterior, colour of flesh or change in colour on breaking, odour, taste, exudation of a milky fluid and so on, are of no special significance in this connexion. All may be of use in the identification of a given specimen but take one no further.

(2) Reliance is sometimes placed on the fact that a species is nibbled by rabbits or squirrels, or is slug-eaten. It is not uncommon to find *Amanita phalloides*, the most poisonous fungus known, nibbled by rodents, and slugs seem to have a great liking for it.

(3) The blackening of a silver coin or spoon is probably the most widely believed "tip" for recognizing a poisonous fungus. *Amanita phalloides* does not blacken silver and, moreover, the pellicle can be peeled from the cap—a sure sign of edibility

to the majority of people. The coagulation of milk or the turning brown or blue of onions placed in a stew with fungi are also assumed characters for poisonous fungi —of equal value.

(4) A common recommendation is that fungi growing on highly manured ground should be avoided and this in spite of the ordinary knowledge of mushroom culture.

Many other similar beliefs have a local following, but in this country, judging from results, it would appear that their efficacy is seldom tried. Whether "seeing them in black and white" in the newspapers will add courage to these beliefs remains doubtful.

The rules advanced by mycologists are often really little better than some of these. Species with a volva, or with pink spores, or which grow in woods are pilloried as those to be avoided. Such rules are to be deprecated not because they lead to the neglect of many well-known esculents, but on account of the false air of security they provide. As there are so few poisonous species the sane way would be to learn to recognize them—or to restrict oneself to the edible species one knows, even if such restriction should confine one to mushrooms from the markets. Covent Garden in our day offers nothing beyond *Psalliota campestris*, but in former times the parasol mushroom (*Lepiota procera*), blewits or bluelegs (*Tricholoma personatum*, *Tricholoma nudum*), chanterelle (*Cantharellus cibarius*) and Sussex and Wiltshire truffles (*Tuber æstivum*) were offered for sale. On the Continent certain markets restrict the sale to specified fungi but others allow any species to be sold after an inspector has certified them as edible.

The question of the food value of fungi was raised in many European countries both during and after the war. Fungi resemble green vegetables in the amount of water they contain (80 to 90 per cent.). There is also from 2 to 5 per cent. proteid nitrogen but a proportion of this is indigestible. Carbohydrates occur as fungus cellulose (about 3 per cent.), sugars (trehalose about 4 per cent., mannite about 1 per cent.), and glycogen. About 1 per cent. of lecithin is present and there is a similar amount of mineral matter. We know that fungi are a complete food from the fact that one or two experimenters have existed solely upon them; also in certain barren countries, or where the inhabitants are of low intelligence, fungi may form the only food, as for example in Fuegia, where the natives subsist on *Cyttaria*. To purchase fungi for their food value would hardly be economical: they are best regarded as appetizers.

The poisonous effects of fungi are of various kinds. First there is *natural idiosyncrasy*, many people being unable to eat fungi of any kind without discomfort. This is analogous to the well known inability to eat strawberries, eggs, &c.

Secondly there is *simple indigestion*. Fungi are somewhat indigestible and portions pass through a perfectly healthy digestive apparatus practically unchanged. Quite wholesome fungi sometimes cause indigestion in cases where there is no defect in the digestive powers. Over-indulgence and faulty cooking are, however, responsible for most of the trouble. A heavy meal of fungi should not be taken when one is fatigued after a long walk, and should not be eaten unaccompanied by other food.

Thirdly, *poisoning by old and altered fungi* is sometimes encountered. Fungi should be eaten fresh, though many of the tougher forms like the morel or the fairy ring champignon may be dried for future use. As in the case of all organic substances changes are soon brought about by the activities of putrefactive bacteria and moulds. The poisoning resulting from eating partly decayed fungi is of similar nature to ptomaine poisoning.

Finally, there is *specific poisoning*. Roch's classification of fungi which contain specific poisons is as follows:—

(1) Those containing substances which excite the muscular apparatus, especially smooth muscular fibres (uterus, vessels, &c.), e.g., *Claviceps purpurea* (ergot).

(2) Those containing hæmolytic substances: e.g., *Gyromitra esculenta*.

(3) Those containing irritant principles which bring about gastro-enteritis by direct action on the mucous lining of the intestines: e.g., acrid species of *Russula* and *Lactarius*, *Entoloma lividum*.

(4) Those containing a substance which paralyses the central nervous system: e.g., *Amanita muscaria*.

(5) Those which, after a long incubation period, bring about the degeneration of the cells of the organism, particularly those of the nervous system and glandular parenchymatous cells, especially of the liver: e.g., *Amanita phalloides*.

The poisons of the first three groups appear to be eliminated during cooking and sometimes even by drying.

From earliest times interest has been taken in neutralizing fungus poisons by special methods of cooking. Pliny suggests that they should be cooked with meat or with pear stalks, and that vinegar neutralizes their dangerous qualities. Gérard, in the fifties of the last century, found that by washing poisonous fungi, leaving them for two hours in water to which had been added a small amount of vinegar, then, after washing and boiling them for half an hour in fresh water, they were rendered perfectly innocuous—needless to say the water used is thrown away. A similar method is described by Fabre in "The Life of the Fly." The peasants of Sérignan and its neighbourhood regularly eat many poisonous and doubtful species, and no one seems to have heard of a case of mushroom poisoning. The method adopted is to "blanch" the mushrooms, that is to say, to bring them to the boil in water with a little salt in it. A few rinsings in cold water conclude the treatment. French mycologists do not favour the method.

The fungi of which I have been speaking, and of which lantern slides will be shown, are all of a size of which the common mushroom can be regarded as an average—a meal of microfungi being out of the question. These larger fungi belong to the great classes Basidiomycetes and Ascomycetes. So far as I am aware no Phycomycetes and no member of the Fungi Imperfecti reach any appreciable size.

Basidiomycetes, which include mushrooms, toadstools, bracket fungi, fairy clubs and so on, are characterized by the fact that their spores are borne on the exterior of a structure known as a basidium, which is usually clavate and has four projections, to which the spores are attached and from which they are violently shot off when they attain maturity.

Ascomycetes, which include cup-fungi, ergot, yeasts, &c., on the other hand, have their spores formed within somewhat similar clavate structures, asci, to the number of eight.

A few words should be said about the spores. These correspond to the seeds of flowering plants, but differ from them in not containing an embryo. In the forms we are considering they are thin-walled, globose or elliptical, with hyaline protoplasm and not infrequently oil as reserve food material. The spore on germination gives rise to the mycelium (spawn). The details of sexuality and development are botanically exceedingly interesting, but would carry us out of our way.

Probably truffles are the best known edible fungi amongst the Ascomycetes. All are subterranean, though some are not deeply buried. They occur principally in calcareous soils, usually associated with the roots of trees. Truffle-grounds are generally poor in undergrowth; the best collecting places are at the edge of woods. Truffles have been prized as esculents from classical times; at that period a widespread opinion was that they were formed during thunderstorms.

As truffles are usually hidden under leaf mould or earth, often to a foot underground, there is considerable difficulty in finding them. Certain animals are, therefore, used for their detection, which they do by scent. Where truffles are not very plentiful dogs are used for hunting them; where they are abundant a sow is more usually employed. The most valued species is the Périgord truffle (*Tuber melanospermum*), which, so far, has not been found in this country. Our

most frequent species is *Tuber æstivum*, which was formerly hunted extensively in Sussex and Wiltshire by means of mongrel terriers and sold in Covent Garden. There is still a small amount of hunting done.

It should be noted that there are also underground genera in the Basidiomycetes which somewhat resemble *Tuber*. The so-called "red truffle," formerly sold in Bath market, is a variety of *Melanogaster variegatus*. The two British species of *Rhizopogon*, *Rhizopogon rubescens* and *Rhizopogon luteolus*, are also edible.

Other well-known esculents among Ascomycetes are species of *Morchella* and

FIG. 1.—*Morcehlla esculenta* Linn.

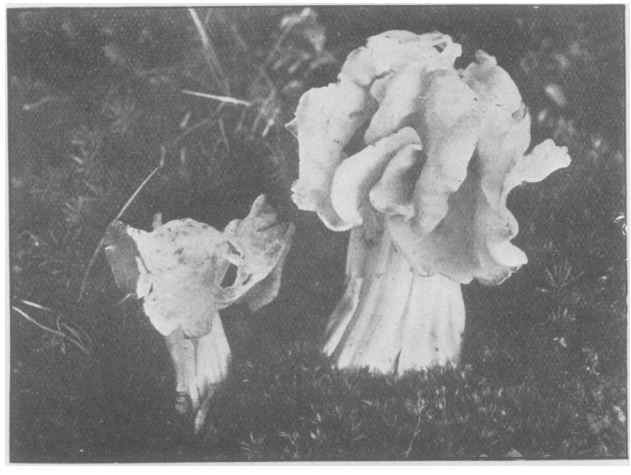

FIG. 2.—*Helvella crispa* Fr.

Helvella. The best-known species of *Morchella* is *Morchella esculenta* (fig. 1), which occurs in spring in the clearings of woods, though all the species are edible. Most frequently morels are used for flavouring soups, sauces, gravies, and in ketchups: they are previously dried threaded on strings.

Most species of *Helvella* are known to be edible, *Helvella crispa* (fig. 2) and

Helvella elastica being most sought after. It is probably advisable to throw away the water in which they are cooked, as occasionally those having partaken of this have complained of its effects, which may be due to helvellic acid. When *Gyromitra esculenta* is cooked—*Gyromitra* is a genus closely allied to *Morchella* and *Helvella* and with its spore-bearing layer covering brain-like ribs or folds—the water should always be thrown away as, in spite of its specific name, the fungus has a bad reputation in Germany, though it would seem that the trouble has always been caused by children eating it raw.

The large cup-shaped fungi of our woods have a clean record so far as I know, but as even the largest species, such as *Peziza aurantia* and *Acetabula vulgaris*, have very little substance there would be more patience required in their collection than risk run in eating them.

It is amongst Basidiomycetes that we meet with the principal edible and poisonous forms. In order to appreciate the lantern slides it is necessary to understand a little about the classification of this group. As modern classification depends to a great extent on microscopic characters it is not so convenient for our present purpose as the one which was generally used in this country until a year or two ago. In this, Basidiomycetes are divided into two orders, Hymenomycetes and Gasteromycetes, according as to whether the spore-bearing surface (hymenium) is exposed either from its beginning or during its development, or enclosed until maturity by a covering of sterile hyphæ ; mushrooms are typical examples of Hymenomycetes, and puff-balls of Gasteromycetes. Different families of Hymenomycetes are distinguished by the arrangement of the spore-bearing surface. In the Agaricaceæ the hymenium is spread over the surface of radiating gills, whereas in the Polyporaceæ it lines the inside of tubular structures or of reticulations ; it is spread over spines or protuberances in the Hydnaceæ and over smooth erect club-shaped sporophores in Clavariaceæ ; the Tremellineæ are gelatinous with a smooth hymenial surface ; the Thelephoraceæ have a smooth or slightly rugose hymenial surface and usually a leathery consistency.

The Agaricaceæ comprise the mushrooms and toadstools. In order to ascertain the genus to which a fungus belongs it is necessary to know the colour of the spores. This can easily be obtained by laying the cap face downwards on a piece of paper or glass. Spore colour viewed in mass is white, pink, brown, purple or black. In addition to the spores the presence or absence of a ring and a volva has to be noted (fig. 1A). The mode of attachment of the gills is also important. When they do not touch the stem they are said to be *free* (fig. 2A) ; when they just reach it, *adnexed ; adnate* when they are slightly attached ; *sinuate* when they show a slight curve or sinus near the stem and *decurrent* when they run down the stem. Thus an agaric with white spores and gills either free or adnexed, and possessing both a ring and a volva belongs to the genus *Amanita*. This is a most important genus to recognize because it contains most of the poisonous fungi.

The most notorious of these is *Amanita phalloides* (fig. 3). The cap in this species has a range in colour from yellowish-olive to whitish and is satiny when dry. Its stem is whitish, often with a tinge of green ; at its middle there is a reflexed ring and at its bulbous base a large membranous volva usually more or less buried in the soil. This species occurs in woods and adjoining pastures from spring to autumn and is very common. It is the most poisonous fungus known and it is responsible for more than 90 per cent. of the deaths caused by fungi : surprisingly small quantities often bring about fatal consequences. The recorded cases of poisoning by this fungus during the last half-century show between 50 and 60 per cent. fatalities. It may be said that in cases of fungus poisoning, if *Amanita phalloides* and its near allies can be ruled out of account, the chance of recovery is almost certain, for no other fungus causes the death of a healthy person. From the extreme danger of this species it is advisable that its distinguishing characters should be impressed upon everyone

undertaking gastronomic experiments with fungi. The clinical symptoms are practically always the same. "After ingestion there is an incubation period of about twelve hours (8-40), during which little or no discomfort is felt. This is followed by a sudden seizure of intense, increasing, abdominal cramp-like pains

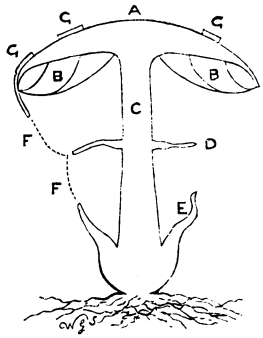

FIG. 1A.—Section of *Amanita phalloides* Secr.: (*a*) cap (pileus); (*b*) gills (lamellæ); (*c*) stem (stipe); (*d*) ring (annulus); (*e*) volva.

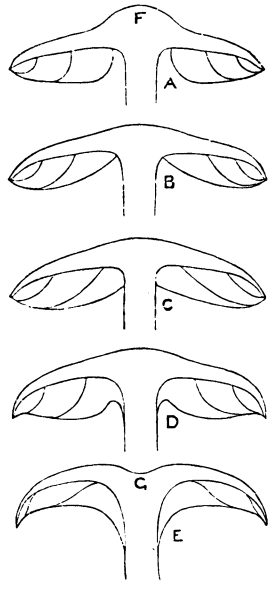

FIG. 2A.—Attachment of gills: (*a*) free; (*b*) adnexed; (*c*) adnate; (*d*) sinuate; (e) decurrent.

FIG. 3.—*Amanita phalloides* Secr.

accompanied by violent vomiting and diarrhœa of undigested food with blood and mucus, later becoming cholera-like. Thirst is very characteristic, incessant demands being made for drink, which, however, cannot be retained. If very little fungus has been eaten the symptoms may begin to abate after two or three days, but recovery

is very slow. Usually, however, violent diarrhœa continues with short periods of intermittence. Loss of weight is very great and the circulation is feeble; there is cyanosis with chilling of the extremities. The kidneys cease to secrete and muscular cramp occurs, especially in the calves. Usually the victim retains his lucidity. At the end of two days, sometimes a little later, there is an amelioration of symptoms—vomiting ceases, colic becomes less frequent, and the patient becomes apathetic and somnolent. This is, however, the most dangerous period. The symptoms soon reappear with intensity, blood is passed and most frequently the nervous system becomes paralysed by degrees, ending in collapse. In the majority of cases death occurs on the third or fourth day. If the period be passed jaundice frequently occurs, indicating fatty degeneration of the cells of the liver, a state resembling that brought about by phosphorus poisoning. In those cases where the patient recovers convalescence is very long."

No antidotal drug for *Amanita phalloides* toxin is known and the treatment usually followed is that for poisoning and septic intoxication in general. Several investigators have succeeded in immunizing animals to the aqueous extract of *Amanita phalloides*, but the attempt to prepare a curative serum has not yet been successful.

The poison concerned has been the subject of much investigation. Kobert (1891) found that extracts of *Amanita phalloides* contain a substance which attacks the red blood corpuscles of man and many animals. This blood-dissolving hæmolysin, *phallin*, was announced to be the active principle concerned. Ford (1906), however, found that this hæmolysin—an easily decomposed glucoside, insoluble in alcohol—is rapidly destroyed at a much less heat than that usually used in cooking and that digestive juices normally break it up. Further, the symptoms of *Amanita phalloides* poisoning are not those of hæmolysis. In addition to hæmolysin Ford found that there is also present a heat-resistant body, which produces in animals the majority of the lesions described in fatal cases of *Amanita phalloides* in man. This "amanita-toxin," an alcohol-soluble active principle, is the essential poison, resisting the action of heat, of drying, and of the digestive juices.

The records of poisoning attributed to *Amanita phalloides* no doubt include those due to two very closely allied species which are sometimes regarded as varieties of *Amanita phalloides*, viz., *Amanita verna* and *Amanita virosa*. Another species which has a very bad reputation is *Amanita mappa*, though it should be stated that evidence is accumulating to the effect that it is not poisonous. The older records may have been of *Amanita phalloides* poisoning, as the two species are sometimes a little difficult to distinguish. *Amanita mappa* never has the olive tinge typically present in *Amanita phalloides;* the cap is usually covered with patch-like fragments of the volva, and there is a groove between the bulbous base of the stem and the thick free margin of the volva.

Probably the best-known poisonous fungus we have is the fly agaric, *Amanita muscaria* (fig. 4), which has a bright scarlet cap with thick white spots and usually grows under birch trees. The appearance of this fungus deters older people from eating it, and further, unlike *Amanita phalloides*, it is bitter and unpleasant in taste. In spite of its popular reputation it is not deadly poisonous. The symptoms in poisoning by this species appear normally one to four hours after digestion. Sometimes the illness is not at all serious, merely colic, vomiting and diarrhœa; and recovery is rapid. At times it takes the form of hallucination, simulating alcoholic intoxication followed fairly rapidly by a deep coma. The gastro-intestinal type is usually accompanied by delirium, loss of memory, convulsions, or prostration, with a tendency to sleep. Recovery is rapid. Apparently the fungus does not cause the death of healthy individuals. Formerly atropine was used as an antidote to *muscarine*. Modern treatment consists in emetics and purgatives with chloral or potassium bromide to allay the delirium. The poison of this fungus has been investigated probably

more than even that of *Amanita phalloides*. Schmiedeburg and Koppe (1869) extracted a substance which they called *muscarine;* at first regarded as an alkaloid but probably a complex ammonia derivative, myceto-muscarine is very active and has well-marked effects, but these, however, are not those characteristic of *Amanita muscaria* poisoning. Further, there is little of it present. An additional fact is that muscarine does not kill flies whereas the fly agaric (broken up in milk) has been used for this purpose since the Middle Ages. At least two other bodies are present, and their different properties possibly bring about the difference in symptoms: myceto-atropine—the effects of atropine on the cerebral nervous system are identical with those produced after ingestion of *Amanita muscaria*—and a large amount of choline which (probably with several other related substances and resinoid bodies) is responsible for the gastro-intestinal disturbances. The way in which many Siberian tribes use an extract of the dried cap of this fungus as a stimulant was described by Krashmannikoff in 1733 and by many later travellers. The habitual use shatters the nervous system and the sale of the fungus by traders was made a penal offence under Russian law. Fungus intoxication enters into religious ceremonies and apparently is regarded as being sufficient to account for any crime and to ensure immunity from retribution. An interesting fresco was described a few years ago from a ruined chapel at Plaincourault (France), dating from 1291, representing the fall of man (fig. 5). There is the traditional serpent twined round the tree of good and evil offering an apple. The " tree " is a branched *Amanita muscaria* and Eve apparently has eaten of the fruit, though Boudier, who described the fresco, suggests that she appears to be suffering from colic rather than shame.

Amongst the other species of *Amanita* which are poisonous is *Amanita pantherina* (fig. 6) which has a brownish cap with numerous white, fairly persistent warts, and a striate margin. The effects brought about by eating this fungus are similar to, but more severe than, those of *Amanita muscaria*. This species, or a closely allied one, is said to be used in Japan for killing flies.

There are other rarer species of *Amanita* which are poisonous, but there are also several which are edible. The two commonest of these are *Amanita rubescens* (fig. 7) and *Amanita spissa*.

Apart from species of *Amanita* there are few fungi that are really dangerous. Indiscriminate eating of toadstools is not however a pastime to be indulged in as the recent experience of certain of His Majesty's forces with *Inocybe incarnata* clearly shows. (See *Journ. Roy. Army Med. Corps*, Jan. 1925.)

The most important genera from a gastronomic standpoint are as follows:—

AGARICACEÆ.

(1) WHITE SPORES.

Amanitopsis: differs from *Amanita* only in having a ring. The four British species are edible, the most valued being *Amanitopsis fulva*.

Lepiota: with ring but no volva; gills free, cap usually scaly. The large species, usually known as parasol mushrooms, *Lepiota procera* (fig. 8), *Lepiota rachodes*, &c., are all esculent. A few of the species of smaller size, e.g., *Lepiota helveola* and *Lepiota carcharias* are said to be suspicious but are probably quite safe.

Armillaria: with ring but no volva; gills adnate or slightly decurrent. None of the fifteen British species is known to be poisonous though the majority are too tough for the taste of most. The very abundant *Armillaria mellea* is frequently eaten on the Continent. This species, incidentally, is our worst tree parasite, and infected wood is often luminous.

Tricholoma: gills sinuate. About one hundred British species. A large number are known to be edible, a few are labelled suspicious, and *Tricholoma tigrinum* is known definitely to be poisonous. This species has a pallid brown to violet grey cap with darker crowded spots and a white involute margin. The incubation period is one to two hours. After a period of stomach pains, nausea and chill, there is abundant and repeated vomiting and diarrhœa with headache and cramp in the calves. The victim is unable to retain any nourishment of any kind. There is complete recovery after from two to six days. The best known

FIG. 4.—*Amanita muscaria* Pers

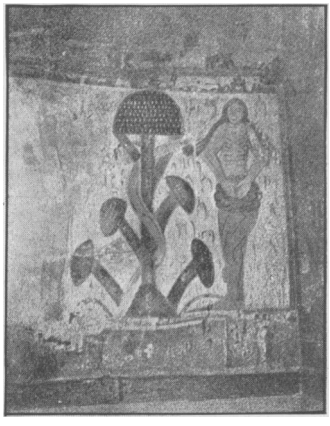

FIG. 5.—Plaincourault Fresco.

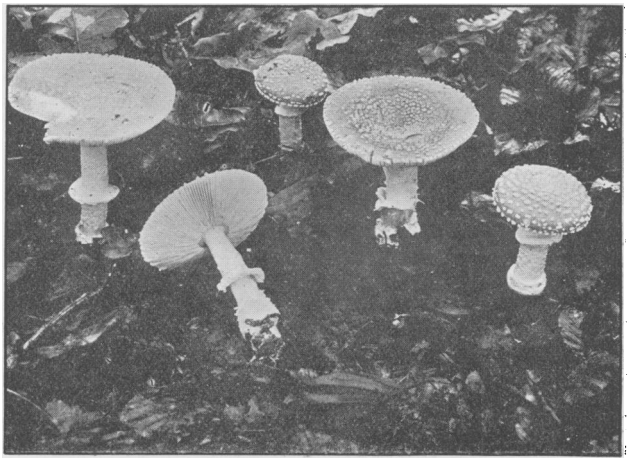

FIG. 6.—*Amanita pantherina* Secr.

edible species are the St. George's mushroom, *Tricholoma gambosum* and blue-leg, blewitts or bluetts, *Tricholoma personatum* and its allies.

Clitocybe: gills decurrent. About eighty British species, probably all of which are edible. *Clitocybe nebularis* is the best of the edible species.

Collybia: characterized by a cartilaginous stem and an involute edge to the cap when young. About eighty British species, probably none of which are poisonous.

Pleurotus: cap usually excentric. About forty British species none of which appears to be poisonous. *Pleurotus ostreatus* is the best known of the edible species.

FIG. 7.—*Amanita rubescens* Pers.

FIG. 8.—*Lepiota procera* Quél.

Paxillus: gills readily separating from the cap. About fifteen British species, mostly edible.

Hygrophorus: gills waxy in appearance. About seventy species, mostly edible, probably none poisonous. *Hygrophorus pratensis* is the best known of the edible species.

Lactarius: all parts of the fungus exude a white or coloured "milk" when broken. About seventy British species. All mild forms are reputed to be edible; probably the acrid forms

only cause discomfort when insufficiently cooked. *Lactarius deliciosus* is the best of the edible species.

Russula: gills fragile, with acute edge and vesicular trama. About sixty British species. No mild species is poisonous; the acrid species are usually avoided but are probably harmless after careful cooking.

Cantharellus: gills decurrent, thick fold-like. About twenty British species. Several are edible, the best known being the chantarelle, *Cantharellus cibarius*.

Marasmius: leathery. Of the fifty or so British species some are edible, but many are used only for flavouring. The fairy ring champignon, *Marasmius oreades*, is a well-known esculent.

Lentinus: leathery; gills decurrent, with serrated edges. About twelve British species. *Lentinus cochleatus* is edible.

(2) PINK SPORES.

Volvaria: with volva but no ring. About ten British species. The larger forms, *Volvaria volvacea*, *Volvaria bombycina*, *Volvaria speciosa*, and *Volvaria gloiocephala*, are all usually regarded with suspicion, though recently many French mycologists have eaten them with no ill-effect.

FIG. 9.—*Entoloma lividum* Quél.

Pluteus: gills free. About fifteen British species. *Pluteus cervinus*, common on stumps, is the only one definitely known to be edible.

Entoloma: gills sinuate. About thirty British species. Most of these are open to suspicion. *Entoloma lividum*, "le grand empoisonneur de la Côte d'Or," is one of the best known poisonous species (fig. 9). The cap is livid tan, the stem shining white with a pruinose apex and the gills whitish, then flesh colour. The fungus smells of new meal. The effects of poisoning by this fungus are very similar to those of *Tricholoma tigrinum*. Diarrhœa sometimes lasts for four to five days. There is often pupillary trouble and a period of syncope. There is great thirst, the throat being so dry that it is impossible to speak. Illness lasts from three to six days and except in very exceptional cases recovery is complete.

Clitopilus: gills decurrent. About twelve British species, none known to be poisonous. The best known species is *Clitopilus prunulus*.

(3) BROWN SPORES.

Pholiota: ring on stem. About forty British species, none known to be poisonous, but mostly tough.

Inocybe: cap minutely scaly or fibrillose-scaly. Over fifty British species; none regarded as edible, and several, e.g. *Inocybe incarnata*, known to be poisonous.

Hebeloma: gills sinuate. About thirty British species, none known to be edible.

Cortinarius: arachnoid cortina connects edge of cap with stem in young stage. There are over two hundred British species, many of which are small. None of the larger forms is known to be poisonous, though only a few are esculent.

(4) PURPLE SPORES.

Psalliota: stem with ring; gills free, whitish, then often pink and finally deep brown. About twenty British species. All are probably edible though *Psalliota xanthoderma* and *Psalliota silvicola* cause discomfort to some people. *Psalliota arvensis* is the horse mushroom, and *Psalliota campestris* the field mushroom (fig. 10). *Psalliota campestris* has been cultivated for about two centuries and so far as can be ascertained its culture began in France. The only other fungus which is cultivated on a large scale is the Japanese Shiitake (*Collybia shiitake.*)

Stropharia: with membranous or fibrillose ring; gills adnate. About twenty British species, none known to be edible.

Hypholoma: gills sinuate; ring composed of hairs. About twenty-five British species only two or three of which are known to be edible.

(5) BLACK SPORES.

Coprinus: cap "deliquescing." About fifty British species. All the larger species are apparently edible, *Coprinus comatus* and *Coprinus atramentarius* being the best known.

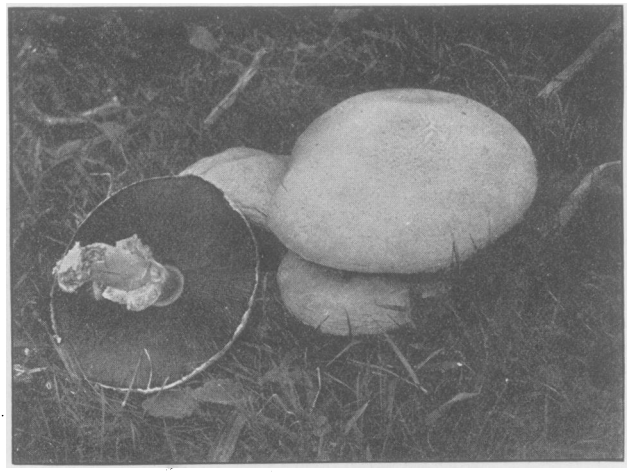

FIG. 10.—*Psalliota campestris* Quél.

Gomphidius: gills mucilaginous, decurrent. Four British species, all of which are edible.

POLYPORACEÆ.

Boletus: cap smooth, tubes coherent. About seventy British species probably all of which are edible if eaten young. *Boletus edulis* (cèpe) (fig. 11), *Boletus reticulatus*, *Boletus pinicola* and *Boletus scaber* are the best flavoured. *Boletus luridus* and *Boletus satanus*, which were formerly regarded as poisonous, are probably quite wholesome.

Fistulina: tubes free. *Fistulina hepatica*, the liver or beefsteak fungus, is the only British species and is best eaten when mature as it is then more tender and less acrid.

Polyporus. One or two of the less leathery bracket fungi such as *Polyporus squamosus* have been eaten, but "taste like saddle-flaps" is not a very enticing invitation to sample any of them.

HYDNACEÆ.

Hydnum. The larger species of this genus with the possible exception of *Hydnum acre* are all edible. The best of them are *Hydnum repandum*, *Hydnum imbricatum*, *Hydnum coralloideum* and *Hydnum erinaceum.*

Tremellodon: gelatinous. The single British species, *Tremellodon gelatinosum* is edible.

THELEPHORACEÆ.

Craterellus: like *Cantharellus*, but the hymenial surface is rugulose. The six British species are edible, the best known being the black, sordid-looking "horn-of-plenty," *Craterellus cornucopioides*, which was formerly sold in Covent Garden.

CLAVARIACEÆ.

Sparassis: much-branched fruit body looking somewhat like a cauliflower. The single British species *Sparassis crispa* (including *Sparassis laminosa*) is esculent (fig. 12).

FIG. 11.—*Boletus edulis* Bull.

FIG. 12.—*Sparassis crispa* Fr.

Clavaria. Fairy clubs. About forty British species, probably none poisonous.

TREMELLINACEÆ.

Hirneola. The Jew's Ear (*Hirneola Auricula-Judæ*) is edible, but more to the taste of the Oriental than to that of the Briton as it gives "a tactile sense to the mastication." An allied species *Hirneola polytricha* is largely exported from New Zealand to Hong Kong.

GASTEROMYCETES.

Phallus. The "eggs" of the stink-horn are eaten in French country districts—presumably as an aphrodisiac.

Lycoperdon. All the twenty or so British species of puff-ball are probably edible in the young stage. The giant puff-ball (*Lycoperdon bovista*) which is a foot or more in diameter is the best known species.

In this survey of the edible and poisonous fungi which occur in Britain it has not been possible to enter into much detail. Sufficient has been said, however, to indicate that poisonous toadstools are comparatively rare. If the poisonous species of *Amanita*, together with *Tricholoma tigrinum*, and the species of *Entoloma* and *Inocybe* are known, little is to be feared.

I am indebted to my friend, Mr. Somerville Hastings, M.S., F.R.C.S., for the photographs of fungi; to my assistant, Mr. E. H. Ellis, for the copy of the plate of the Plaincourault Fresco (from *Bull. Soc. Mycol.*, France, xxvii, 1911), and to the Trustees of the British Museum for the loan of the blocks of the two line drawings from the Museum "Handbook of the Larger British Fungi," a work from which more details can be obtained on matters dealt with in this lecture.

A Cinematograph Demonstration of the Biology of Bilharzia Disease was given. The film (the property of the South African Institute for Medical Research, and kindly lent by Dr. W. Watkins-Pitchford) was shown.

Dr. J. B. CHRISTOPHERSON said that the film had primarily been made for educational purposes for use in South Africa in those districts in which schistosomiasis was prevalent. It had been sent over for the British Empire Exhibition, Wembley, 1924, to be shown on the cinematograph together with other representations of South African subjects. It had not been found possible to exhibit it at Wembley. It had been shown at the International Congress of Public Health, at Bordeaux, June 5, 1924, and it was being demonstrated that evening at the meeting of the Tropical Diseases Section, by permission of Dr. Watkins-Pitchford. The film had been constructed and worked out by Dr. Annie Porter, Parasitologist to the South African Institute. All the stages of the biological development of the bilharzia worm, outside and inside the body of the host, were shown, including living miracidia and cercariæ which were microscopic and not easy to represent by the cinema. Still, success had been obtained. The film included a representation of a demonstration by a doctor in South Africa giving the intravenous injections of antimony tartrate for schistosomiasis. It would be noticed that the doctor was giving the injections to the patient standing. In Egypt the patient received the injections sitting, whereas in England the injections were given to the patient lying down.

Dr. Christopherson reminded Members that Dr. Annie Porter was exhibiting that evening: (1) Specimens of South African molluscan hosts of schistosomes. (2) Specimens of plants on which the water-snails fed and lived. (3) A map showing the distribution of schistosomiasis in South Africa.

After the demonstration a vote of thanks to the South African Institute for Medical Research and to Dr. W. Watkins-Pitchford for the loan of the film, was proposed by Sir Leonard Rogers, and unanimously carried.